Space Weather Technical Forecast

Issued on Friday, 03 December 2021 at 00:49 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor Storm activity.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was very low, with no significant flares detected. There are currently two sunspot regions on the visible disc; AR2898 and AR2902, with previous AR2900 now behind the western limb. AR2898 remains a stable and simple Hsx group. The penumbra on AR2902 has recently diminished and is now barely visible, with the region close to being classified as Bxo or Cro. No Earth-directed CMEs were seen in available imagery, although a CME that left the Sun on the 29th may give Earth a glancing blow this morning.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by DSCOVR at L1, started at elevated levels generally between 510-530 km/s, then gradually declined to end the period around 480 km/s. Density remained at average levels. Total IMF (Bt) was weak below 8 nT, with its north-south component (Bz) ranging between +4/-5 nT and was occasionally negative/southward pointing. Phi angle was predominantly in a positive orientation (away from the Sun). Resultant geomagnetic activity was Quiet to Unsettled levels (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) remained at background levels. The high energy electron flux (greater than 2 MeV) increased above the High threshold (1000 pfu) from 02/1110 UTC, and peaked at 29200 pfu at 02/1710 UTC. The associated 24-hour integrated fluence remained below the Active threshold (1e8 integrated pfu), though with a steadily increasing trend. Observed fluence at 03/0000 UTC was 1.0e8 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain predominantly very low, with a chance of C-class flares, primarily from AR2902. No significant regions are expected to rotate onto the visible disc.

Solar Wind / Geomagnetic Activity: The influence of CH26 has started to decline, but before the solar wind reaches background levels further coronal hole enhancements are expected today from CH27. The influence is expected to persist through tomorrow (4th), followed by a further possible connection with CH28/+ for days 3 and 4 (5th and 6th). A filament eruption which left the Sun on the 29th, may also bring a brief enhancement to solar winds this morning from a glancing blow to Earth. Mostly Quiet to Unsettled (Kp 2-3) geomagnetic activity is expected, with isolated Active (Kp 4) intervals, and a chance of isolated G1/Minor Storm (Kp 5) intervals.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) is expected to remain at predominantly High levels, only occasionally decreasing to moderate levels during the diurnal cycles and when any significant geomagnetic activity occurs.

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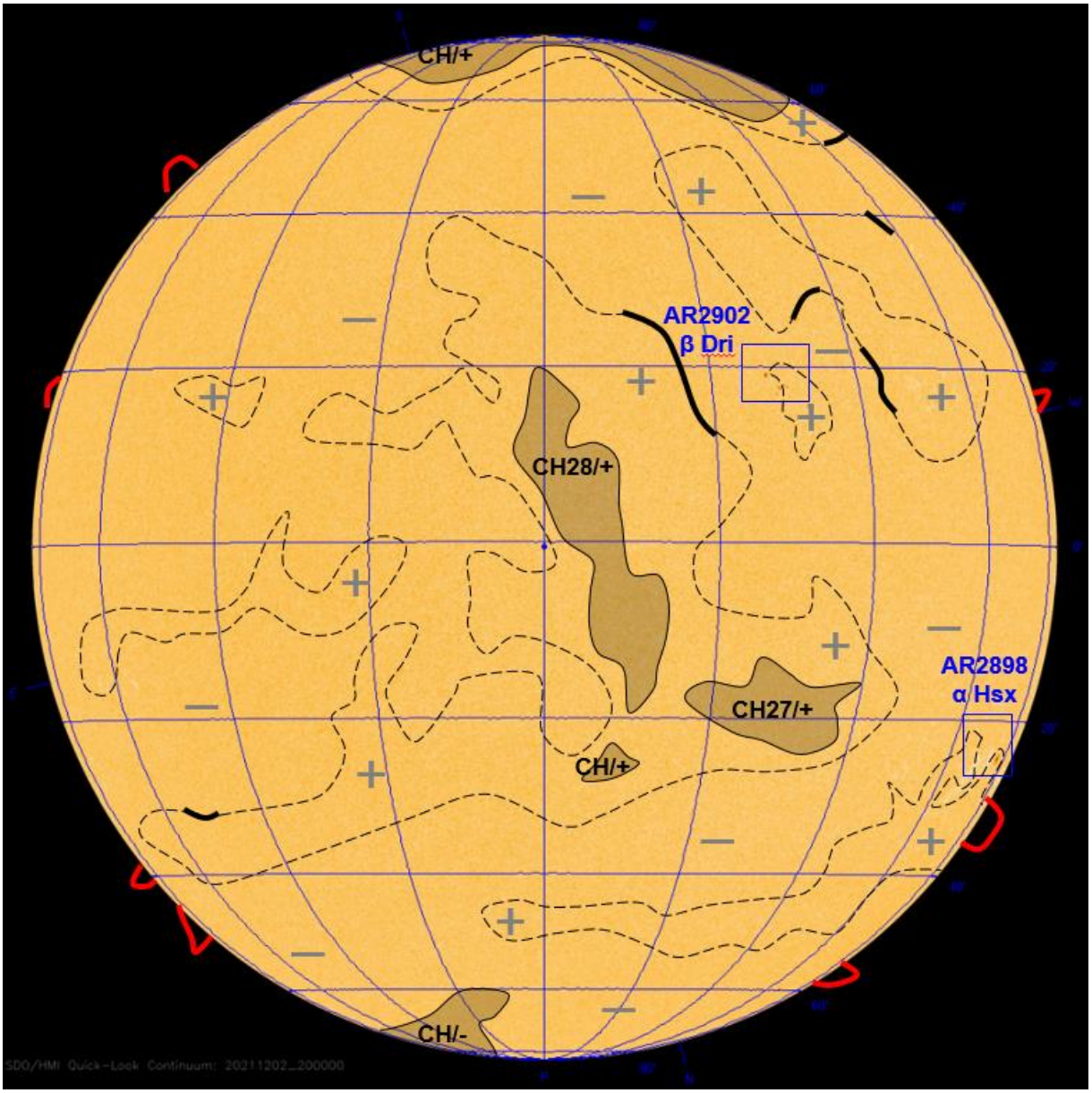
The associated 24 hour integrated fluence is likely to remain above the Active threshold (1e8 integrated pfu) throughout, with a slight chance of reaching Very Active levels during days 3 and 4 (5th and 6th) under the continued influence of various coronal hole high speed streams.

Figure 1. Solar Analysis Valid 02/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A filament eruption which left the south centre disc of the Sun on the 29th may bring a brief enhancement to solar winds this morning with a possible glancing blow, although the majority of the ejecta is expected miss the Earth. There are no other Earth directed CMEs in the forecast. The solar wind parameters indicate a slight decline in the connection with the HSS from CH26/+. The next coronal hole feature, CH27/+, appears to be more significant, with its associated high speed stream expected to arrive today. There is the potential for a strong solar wind (perhaps near 700 km/s, which has been observed from some coronal holes in the southern disc during the last month). Enhanced observed solar winds from STEREO-A on 29th may also indicate enhanced solar winds from CH27 reaching Earth today. The next coronal hole CH28/+ is likely to become geoeffective during day 3 (5th), then persisting through day 4 (6th). Therefore throughout the forecast period Earth will be influenced by various HSS from different coronal hole features.

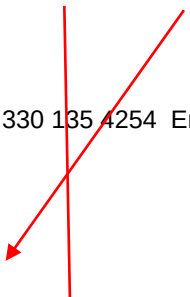
Mostly Quiet to Unsettled (Kp 2-3) geomagnetic activity is expected, with isolated Active (Kp 4) intervals, and a slight chance of isolated G1/Minor Storm (Kp 5) intervals each day.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
29/1553 UTC	Partial	Filament eruption	South centre disc	570 km/s	02/1800 UTC +/- 12 hours	Glancing blow with low confidence

Figure 2: Latest SDO AIA-193 image showing CH27 and CH28.



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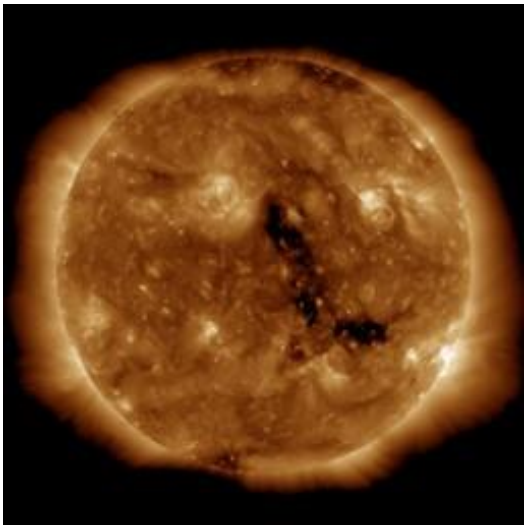
Met Office Space Weather Technical Forecast



Radio Blackouts - X-Ray Flares:

Flare activity is currently very low, with any future enhancement to the X-ray flux most likely from AR2902. However, the penumbra on AR2902 has recently diminished and is now barely visible, with the region close to being classified as Bxo or Cro. The issued probabilities of significant flares are markedly lower than the theoretical raw probabilities, because of the lack of recent activity, and the simplifying of AR2902.

Solar activity is likely to remain low or very low, with a chance of C-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	1	1	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

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The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is forecast to remain at background levels, with no solar radiation storms anticipated.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

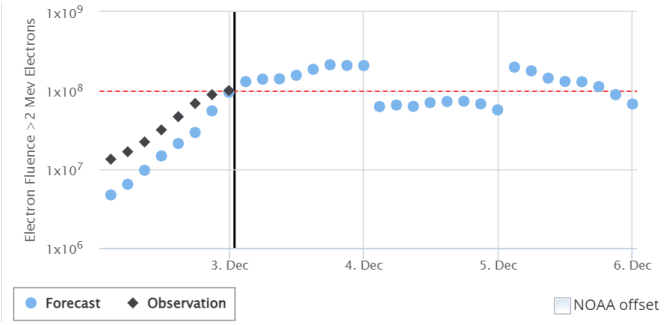
High Energy Electrons Event (≥ 2MeV):

Under the influence of various CH HSS the high energy electron flux (greater than 2 MeV) is expected to remain at predominantly High levels, only occasionally decreasing to moderate levels during the diurnal cycles and when any significant geomagnetic activity occurs.

The associated 24 hour integrated fluence is likely to remain above the Active threshold (1e8 integrated pfu) throughout, with a slight chance of reaching Very Active levels during days 3 and 4 (5th and 6th) under the continued influence of various coronal hole HSS. This is broadly supported by REFM, with the fluence forecast to remain above Active today and day 3 (5th).

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	100	70	70	70
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	5	10

Figure 3: Latest Met Office REFM model.



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